

Remarks

Claims 1, 2, 4-8 and 11-19 were pending.

Claims 5-8 and 11 are canceled.

Claim 1 is amended.

Claims 1, 2, 4 and 12-19 are now pending.

Claim 1 is amended to include the limitations of claims 5, 8 and 11. The present claims now require the phyllosilicate nanoparticles to be modified by an ammonium or a phosphonium compound. The stabilizer of component b) is now limited to the specific ones listed in claim 1. The mono or polyfunctional compound of component d) is now limited to bisphenol A diglycidyl ether, bisphenol F diglycidyl ether, diglycidyl 1,2-cyclohexanedicarboxylate or phenol novolak epoxy resin.

No new matter is added.

Claims 1, 2, 4-8 and 11-19 are rejected under 35 USC 103(a) as being unpatentable over Fumitoshi, JP04-68133 in view of Ton That, U.S. Pat. No. 7,220,484.

These rejections are for reasons of record.

Fumitoshi is cited as disclosing polyolefin resin comprising:

- B) an inorganic filler;
- C) a specific phenolic antioxidant;
- D) a sulphur containing antioxidant;
- E) a nitrogen containing antioxidant and
- F) a bisphenol A type epoxide. (Claim 1)

Fumitoshi also discloses phosphorus containing stabilizers, paragraphs [0039]-[0040].

Fumitoshi does not disclose nano-scaled filler particles.

Ton That discloses a nanocomposite comprising a nano-reinforcing material (a layered clay), a polymer matrix and an epoxy-functionalized graft polymer (Abstract). The clay may be modified with a quaternary ammonium compound, col. 6, lines 3-40. Suitable as a polymer matrix are thermoplastic polymers such as polyolefins, col. 6, lines 57-66.

The Examiner states that it would have been obvious to one of ordinary skill to utilize the treated clay of Ton That in the teaching of Fumitoshi and arrive at the claimed invention.

To rebut these rejections, Applicants pointed to the results of the working Examples and submitted a Rule 132 Declaration by Dr. Rainer Xalter.

The Examiner discusses the Rule 132 Declaration starting on page 5 of the present Office Action.

The Examiner states that the Declaration compares untreated filler and treated filler, while the claims do not require treated filler. The present claims now require the phyllosilicate to be treated.

The Examiner also states that OIT (oxidation induction time) measurements provided in the Declaration cannot be utilized to compare against the prior art Fumikoshi as the prior art does not disclose OIT measurements. Fumikoshi discloses YI (yellowness index) measurements. Applicants submit that OIT and YI measurements are both common methods employed in the field, and that they parallel each other. A rapid oxygen uptake leads to rapid oxidation which results in a yellow to brown appearance of the polymer. OIT measurements and YI measurements may be qualitatively compared. OIT is a common and accepted method to compare polymer stability.

The Examiner also states that the results of the Rule 132 Declaration are not unexpected (top page 7 of Action). Applicants have indeed shown that stabilization is filler dependent and therefore unexpected. The results of the Declaration show that conclusions drawn from polymers with conventional fillers cannot be extended to nanocomposites.

Applicants reiterate their arguments of the response filed February 23, 2009.

The instant invention is directed to the stabilization of thermoplastic polymers filled with nano-scaled clays. The clays are generally modified with long chain alkyl or dialkyl ammonium ions or amines or in a few cases onium ions such as phosphonium. The ammonium ion/amine additives are usually incorporated into the clay structure by a separate solution intercalation step. See the paragraph bridging pages 1 and 2 of the disclosure.

These organic modified clays have a number of disadvantages when used for the preparation of polyolefin nanocomposites. Ammonium salts are thermally unstable at temperatures used in polyolefin processing or may be otherwise reactive under processing conditions. These instabilities result in poor processing stability, inferior mechanical properties, discoloration, odor formation and reduced long term stability. See the first full paragraph, page 2 of the disclosure.

The inventors have surprisingly found that improved nanocomposites with an increased thermostability, with reduced odor and reduced undesired discoloration, which occurs as a result of the decomposition of the modification agents, can be prepared by the use of a mixture comprising a phenolic antioxidant and/or processing stabilizer and a mono or polyfunctional compound selected from the group of certain epoxides (as defined in present claim 1).

The results are surprising; the combinations show a significant improvement when compared to the individual stabilizers (Table 1, page 56). When the epoxide compound is added to the stabilizers (Examples 1e, 1f and 1g), color is improved and heat stability is maintained, compared with the samples containing the stabilizers alone (Examples 1b, 1c and 1d). The total concentration of additives has been kept equal in all cases. These results are surprising and could not have been expected based on the combined disclosures of the cited art.

In order to further point out this unexpected surprising effect, Applicants previously submitted a Rule 132 Declaration by Dr. Rainer Xalter. Three series of experiments have been carried out which are presented in Tables 1-3. Table 1 shows the results of classically filled polymers with a low degree of filler (5 wt. %), which would be typical for nano-scaled fillers. Stabilization with Irganox B 225 (phenolic antioxidant and phosphite process stabilizer) alone results in an OIT of 9.9 minutes. The addition of 5 wt.-% Cloisite Na⁺ results in an improvement up to 32.5 minutes. Further addition of Araldit GT 7072 (bisphenol A type epoxide) significantly decreases the value down to 15.4 minutes. In other words, in a classically filled polymer with low degree of filler the addition of the epoxide is detrimental.

Table 2 shows the results of classically filled polymers with a conventional degree of filler (20 wt. %, see Fumitoshi). Stabilization with Irganox B 225 (phenolic antioxidant and phosphite process stabilizer) alone results again in an OIT of 9.9 minutes. The addition of 20 wt. % Cloisite Na+ results in reduction down to 2.7 minutes. Further addition of Araldit GT 7072 (bisphenol A type epoxide) improves the OIT value up to 7.0 minutes, the value of the unfilled system, however, is not reached. In other words, in a classically filled polymer with conventional degree of filler the addition of the epoxide improves the OIT value. However, the stability of the unfilled sample is not reached.

Table 3, Example 3.3 shows the result which is obtained according to the instant invention. Stabilization with Irganox B 225 (phenolic antioxidant and phosphite process stabilizer) alone results in an OIT of 9.9 minutes. Addition of 5 wt % Cloisite 20A (nano-scaled phyllosilicate) reduces the OIT value to 7.5 minutes (compare Table 1 classically filled system with 5 wt. % degree of filling where an improvement has been observed). Further addition of Araldit GT 7072 (bisphenol A type epoxide) improves the OIT value significantly up to 13.0 minutes which is definitely higher than the OIT value of the unfilled sample.

The results show that conclusions drawn from polymers with conventional filler cannot be extended to nanocomposites. The results are unexpected and can not be deduced from the combined disclosure of the cited art.

In view of this discussion and the results of the Xalter Declaration, Applicants submit that these rejections are addressed and are overcome.

Claims 1, 2, 4-8 and 11-19 are rejected under 35 USC 103(a) as being unpatentable over Chin, WO 03/002651 in view of Fumitoshi.

Fumitoshi is cited as above.

Chin is cited as disclosing nanocomposites where the polymer substrate is polyolefin. Phenolic stabilizers are disclosed. Chin does not teach epoxy compounds.

The Examiner states that it would have been obvious to one of ordinary skill in the art to utilize an epoxy compound of Fumitoshi in the composition of Chin and thereby arrive at the present invention.

To rebut these rejections, Applicants point to the outstanding and unexpected results of the working Examples and the Xalter Declaration.

Applicants submit that these rejections likewise are addressed and are overcome.

In view of all of the above, Applicants submit that each of the 35 USC 103(a) rejections are addressed and are overcome.

The Examiner is kindly requested to reconsider and to withdraw the present rejections.

Applicants submit that the present claims are now in condition for allowance and respectfully request that they be found allowable.

Respectfully submitted,



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Attachment: Petition for a 1 month extension of time